Event Builder & Level3
— Overview for Aces —

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Summary

- Introducing the EVB/L3 systems: function, layout, location
- EVB overview
- L3 overview
- Monitoring tools: Ace Control Panel, L3 Display
- Errors and recovery
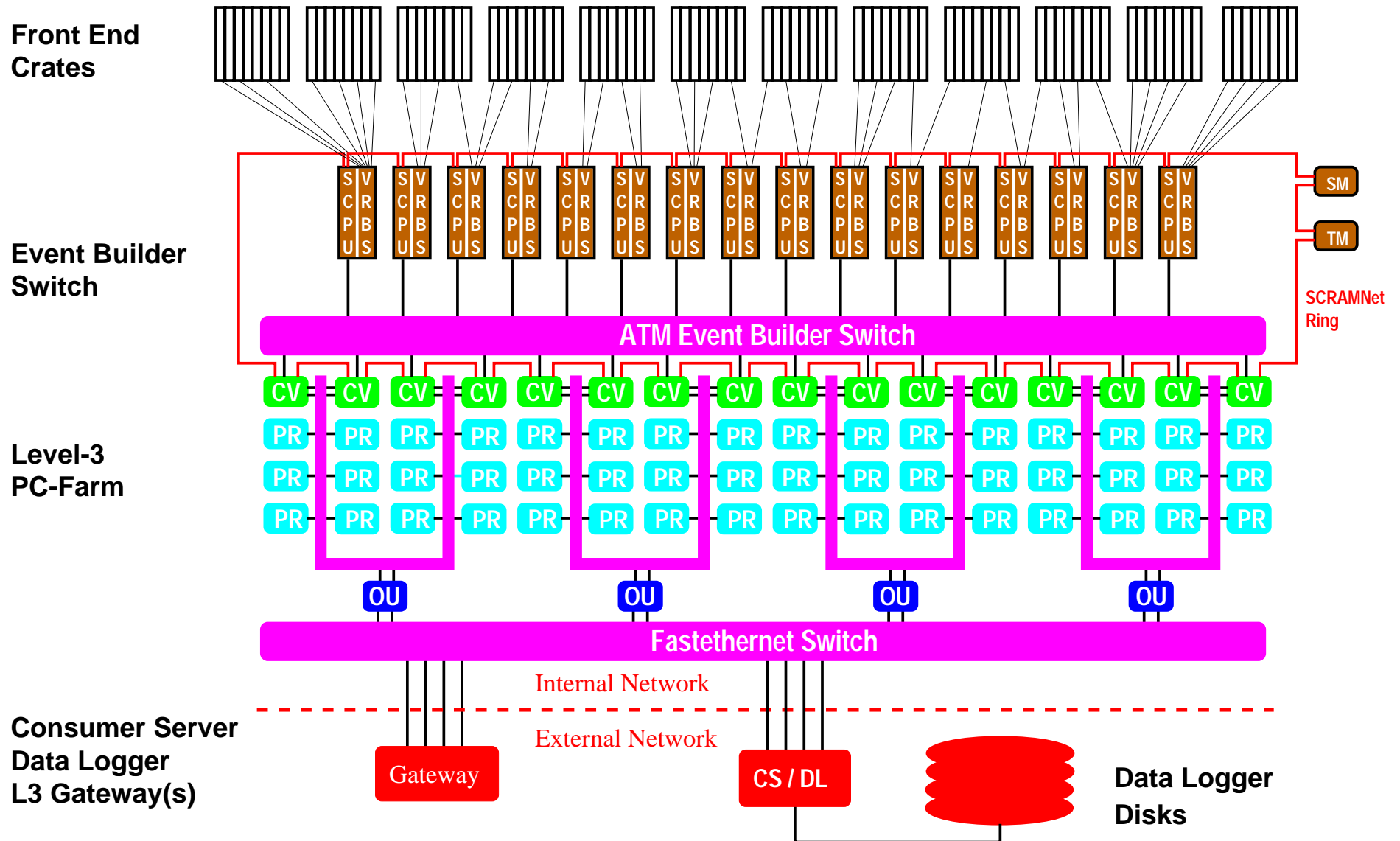- Support, documentation, people

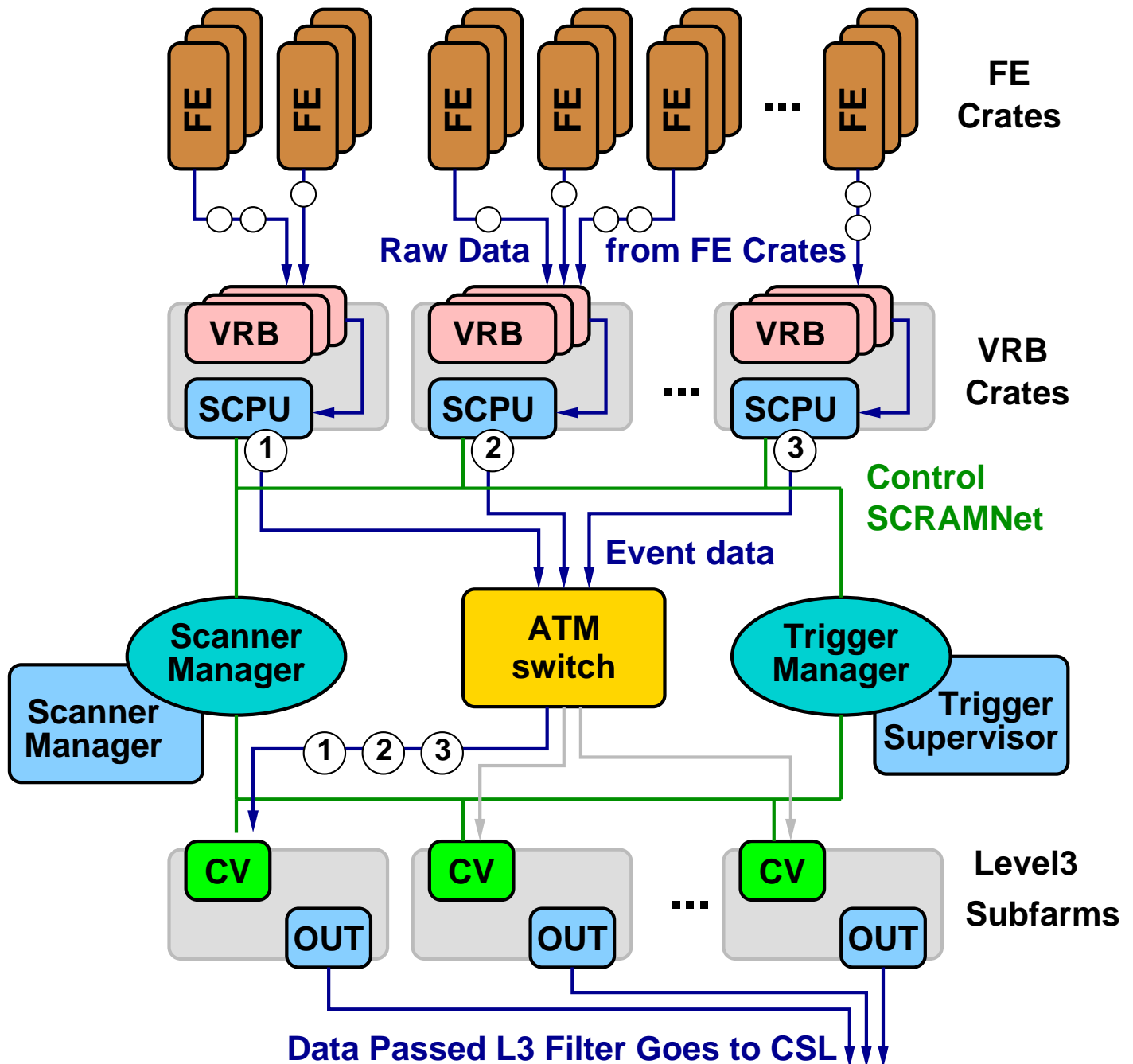*Several diagrams taken from CDF note 5793*

The EVB hardware

The L3 farm

System Overview

Front End Crates

Event Builder Switch

SM

TM

SCRAMNet Ring

ATM Event Builder Switch

SVCPRBUS (×18)

Level-3 PC-Farm

CV PR OU

Fastethernet Switch

Internal Network

External Network

Consumer Server Data Logger L3 Gateway(s)

Gateway

CS / DL

Data Logger Disks

Event Builder Overview

FE Crates

Raw Data **from FE Crates**

VRB Crates

Control SCRAMNet

Event data

Scanner Manager

ATM switch

Trigger Manager

Scanner Manager

Trigger Supervisor

CV **CV** **CV** **Level3 Subfarms**

OUT **OUT** **OUT**
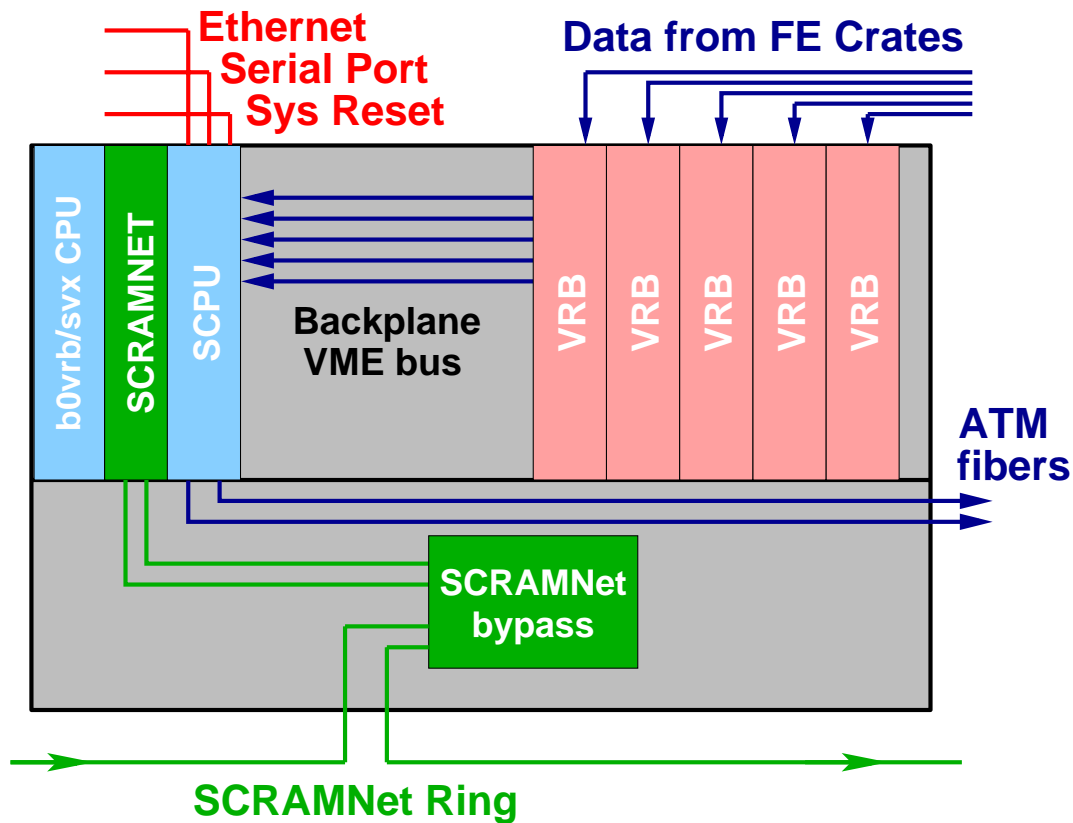
Data Passed L3 Filter Goes to CSL

Event Builder :
Assembles event fragments from FE crates together into a single event piece.

Level3 :
Runs executable (filter) which makes L3 trigger decision.

EVB crate

Ethernet
Serial Port
Sys Reset

Data from FE Crates

b0vrb/svx CPU

SCRAMNET

SCPU

**Backplane
VME bus**

VRB VRB VRB VRB VRB

**ATM
fibers**

**SCRAMNet
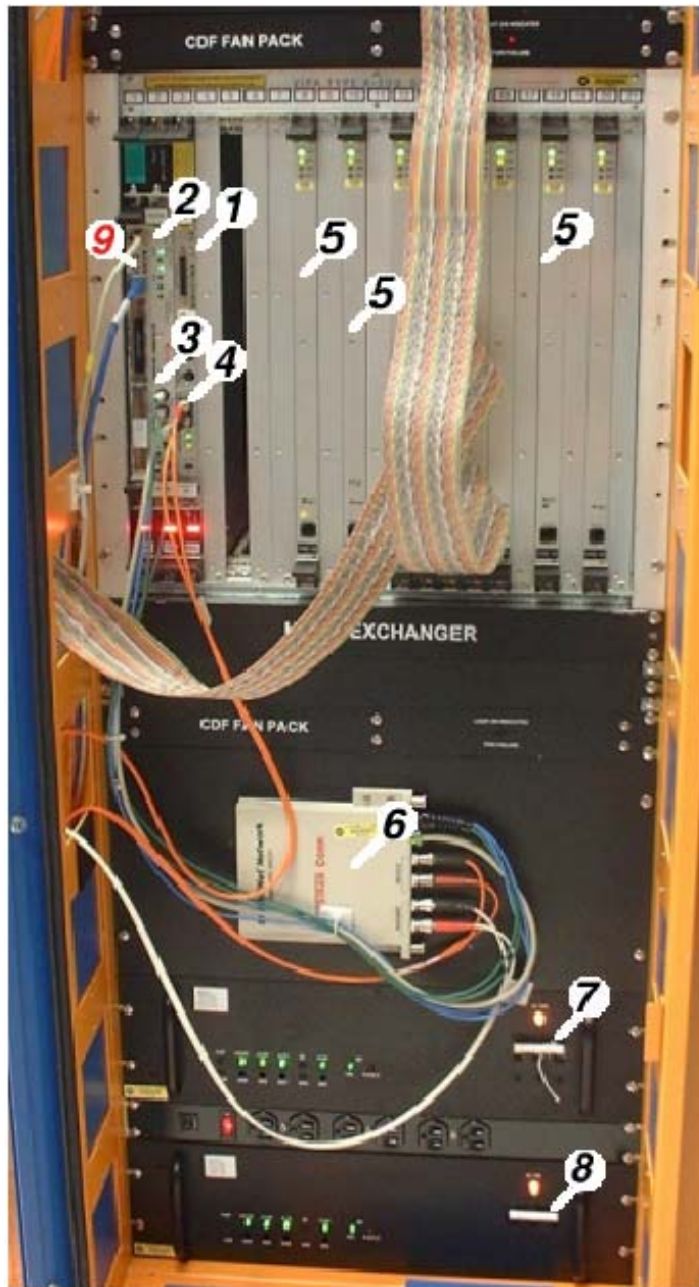bypass**

SCRAMNet Ring

Functions:

- Event pieces (links) are loaded to VRBs by FE crates
- Scanner Manager (SM) detects L2 trigger from Trigger Manager
- Scanner Manager notifies SCPUs about trigger
- Scanner CPUs (SCPUs) read VRB banks from VRBs concatenating them into one piece
- All Scanner CPUs send event fragments through ATM to a single Converter chosen by SM

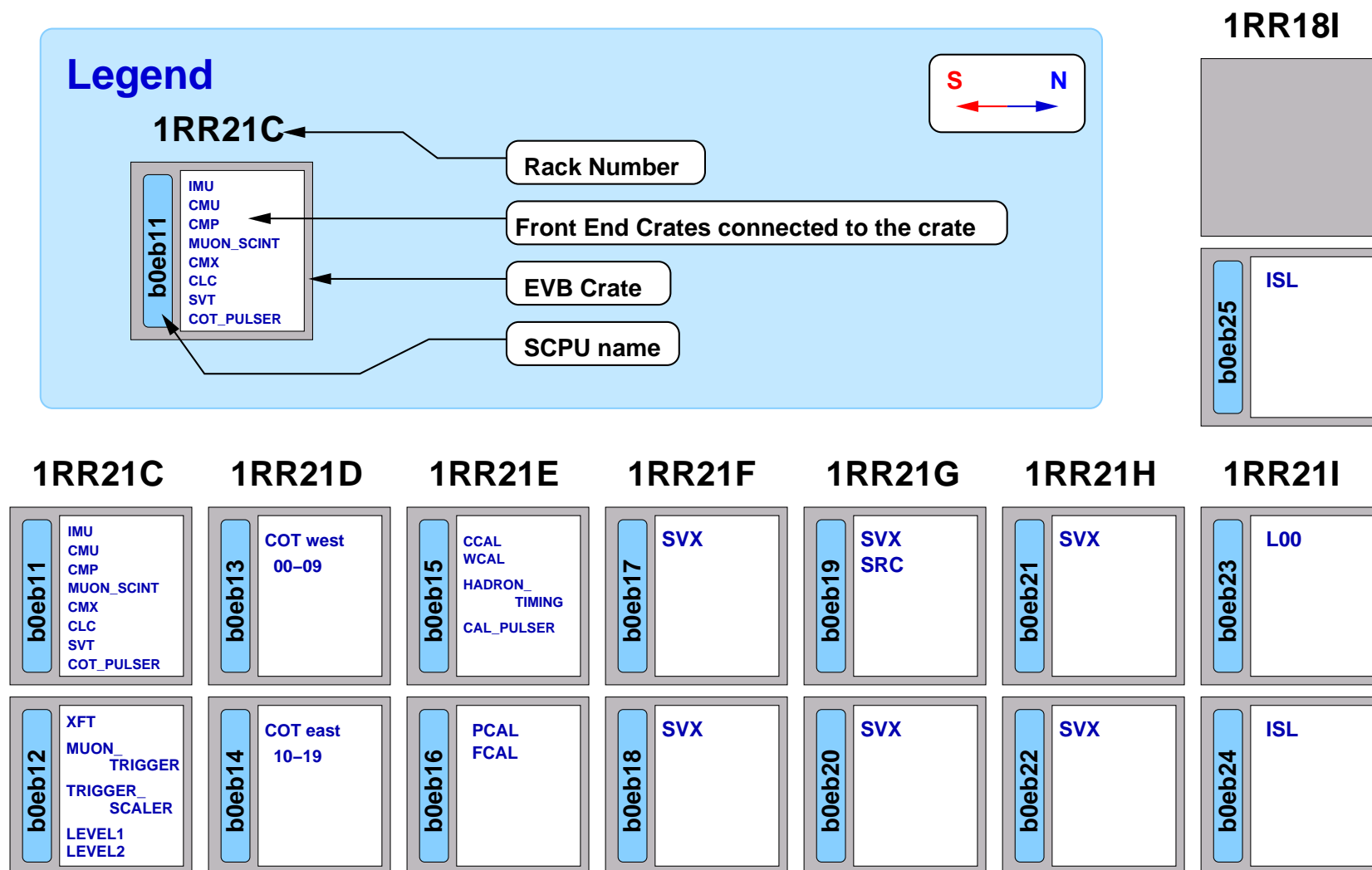Event Builder always talks to all SCPUs, so all VRB crates must be alive!
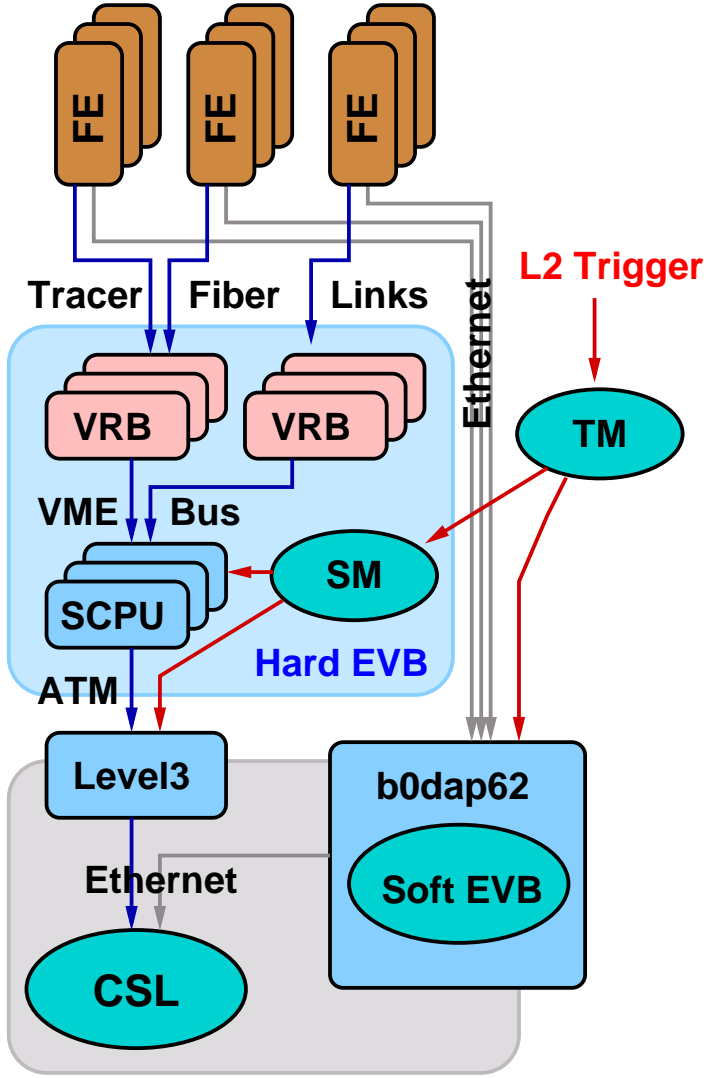
EVB Crate Possible Actions

1. SCPU Reset Button
2. ScramNet Card Lights
3. ScramNet Fibers
4. ATM Fibers
5. VRBs
6. ScramNet Bypass
7. Upper Crate Power Switch
8. Lower Crate Power Switch
9. Crate Reset Button

- Reboot Crate - do software reboot from control room.
- Reset SCPU - push reset button on SCPU.
- Reset Crate - push reset button on master board. (Only if said by expert or popup window)
- Powercycle the Crate - Turn the power switch off, wait for 30 sec, and turn it on. (Only if said by expert or popup window)

Running Multiple Hardware Partitions with L3/EVB

1RR18I

Legend

1RR21C ← Rack Number

b0eb11
- IMU
- CMU
- CMP
- MUON_SCINT
- CMX
- CLC
- SVT
- COT_PULSER

Front End Crates connected to the crate

EVB Crate

SCPU name

S N

b0eb25 — ISL

| 1RR21C	1RR21D	1RR21E	1RR21F	1RR21G	1RR21H	1RR21I
b0eb11: IMU, CMU, CMP, MUON_SCINT, CMX, CLC, SVT, COT_PULSER	**b0eb13**: COT west 00–09	**b0eb15**: CCAL, WCAL, HADRON_ TIMING, CAL_PULSER	**b0eb17**: SVX	**b0eb19**: SVX, SRC	**b0eb21**: SVX	**b0eb23**: L00
b0eb12: XFT, MUON_ TRIGGER, TRIGGER_ SCALER, LEVEL1, LEVEL2	**b0eb14**: COT east 10–19	**b0eb16**: PCAL, FCAL	**b0eb18**: SVX	**b0eb20**: SVX	**b0eb22**: SVX	**b0eb24**: ISL

Software Event Builder

- Takes event data directly from FE crate by Ethernet.
- Runs data merger package, Reformatter and Level3 filter.
- Can work in Hardware or Software partitions.
- Generally much slower than Hardware EVB.

Do not page Hardware EVB pager about Software EVB problems :)

L3 subfarm definition
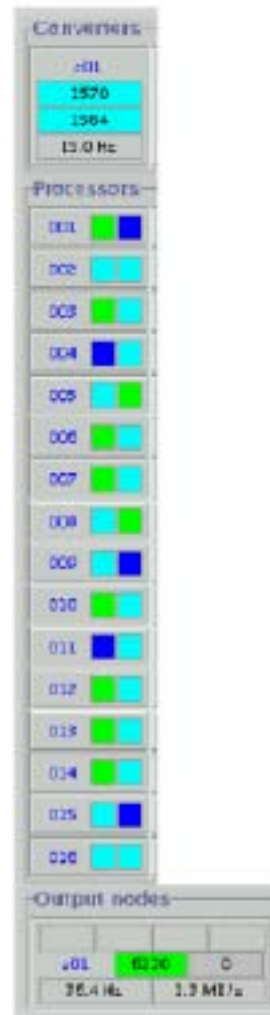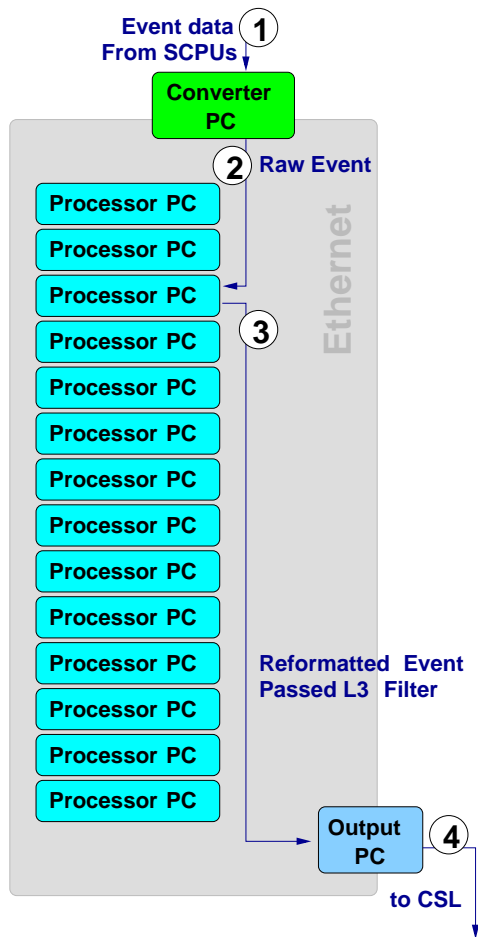
Functions:

1. Event fragments come to the Converter node from SCPUs.

2. Converter combines fragments into one piece (raw event) and sends it to free Processor node in a subfarm.

3. Processor PC rearranges event data to offline (TryBoss) format and applies L3 trigger. Passed events are written to the Output node.

4. Output node forwards event to CSL.

Processor node details
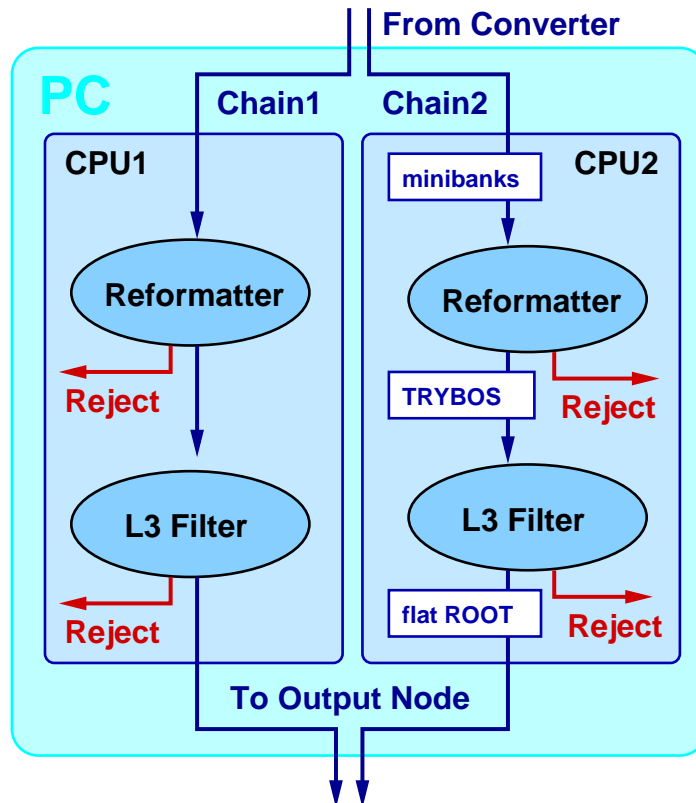
Two analysis chains are independent and process different events.
(Two boxes on Level3 Display)

Reformatter:
- Rearranges events to standard offline format
- Performs a number of data quality checks.
- Discards corrupted events
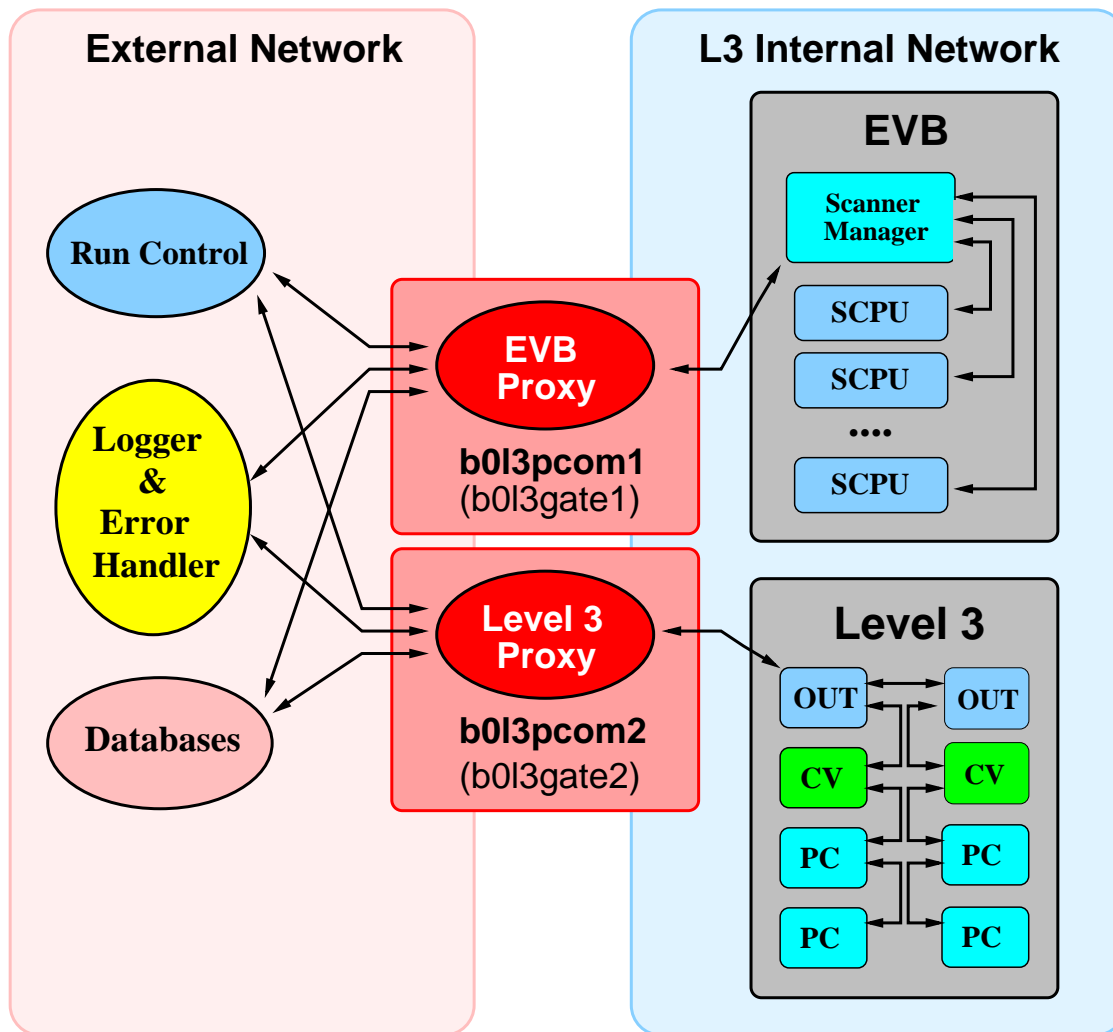- Generate Reformatter error if event is rejected.

L3 Filter:
- Runs offline-type reconstruction
- Determines event type. Decides pass/fail
- Failed events are discarded

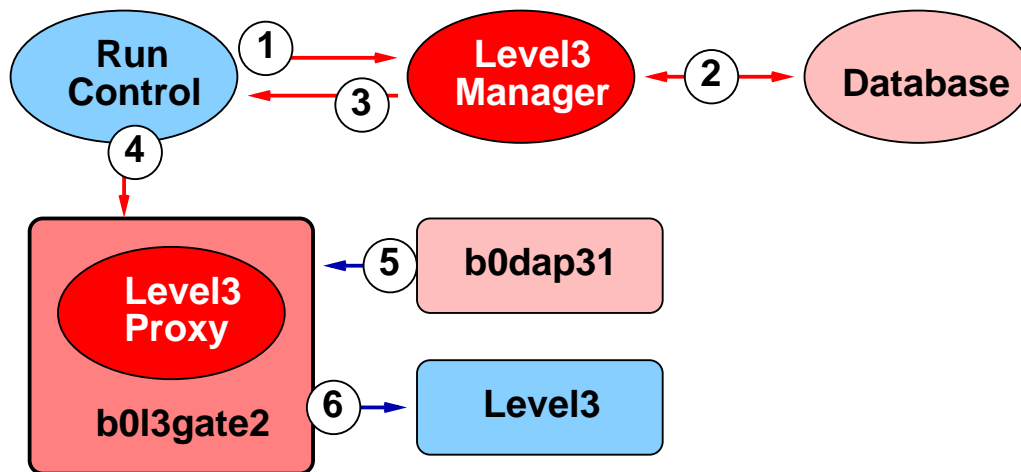Events can be discarded by both Reformatter and L3 Filter!
Level 3 Filter executable is selected in Run Control GUI

Gateways and proxies

- Connect RC and EVB/L3. Forward transition messages.
- Transport error messages to RC Error Logger.
- Transport monitoring information.
- Both must be alive for the system to work.

Level3 Manager

1. RC requests a new Calib tag from L3 Manager.

2. L3 Manager requests Database for a new Calib tag.

3. L3 Manager generates Calib tag if a new calibration exists. Return the Calib tag number to RC.
   If this step is failed RC generates "orange window of death" and proceeds with default Calib tag.

4. RC notifies Level3 Proxy.

5. Level3 Proxy picks up Calib tag generated by L3 Manager from online computer.

6. Level3 Proxy distributes Calib tag over Level3 Farm.

Do not page Level3 pager about L3 Manager problems. :)

Monitoring Tools

- EVB/L3 Ace Control Panel
  - → Started with **EvbControl**
- L3 Display
  - → On daqmon GUI select L3
- EvbDaqmon *(Obsolete)*
  - → On daqmon GUI select EVB

- Dead Time Display
  - → On daqmon GUI select Rates and Deadtimes
- daqmon
  - → Started with **setup fer; daqmon**
- Run Control
  - → Started with **setup fer; rc**
- Error Handler
  - – Started with Run Control

- Note: detailed instructions on EVB/L3 web pages

RC parameters

. Include one, several or all Level3 subfarms.

. Include Hardware Event Builder.

. Choose Level3 tag.

EVB/L3 Ace Control Panel

Ace Controls for EVB and L3 farm (release 2.17)

EVB and L3 actions

Checks
- EVB proxy
- L3 proxy
- SCRAMNet
- SM + SCPUs
- ATM switch

EVB proxy control
- Start
- Stop
- Send Abort

L3 proxy control
- Start
- Stop
- Send Abort

CLEAN UP actions:
- Clean up EVB
- Clean up L3 farm
- Clean up L3 mon

Other actions:
- Exit

```
                                          Ok
Results for b0l3c02 ----------------------------------------
                                          Ok
Results for b0l3c03 ----------------------------------------
                                          Ok
Results for b0l3c04 ----------------------------------------
                                          Ok
Results for b0l3c05 ----------------------------------------
                                          Ok
Results for b0l3c06 ----------------------------------------
                                          Ok
Results for b0l3c07 ----------------------------------------
                                          Ok
Results for b0l3c08 ----------------------------------------
                                          Ok
Results for b0l3c09 ----------------------------------------
                                          Ok
Results for b0l3c10 ----------------------------------------
                                          Ok
Results for b0l3c11 ----------------------------------------
                                          Ok
Results for b0l3c12 ----------------------------------------
                                          Ok
Results for b0l3c13 ----------------------------------------
                                          Ok
Results for b0l3c14 ----------------------------------------
                                          Ok
Results for b0l3c15 ----------------------------------------
                                          Ok
Results for b0l3c16 ----------------------------------------
                                          Ok
Done
l3proxy CLEAN
No such process 27436.
New l3proxy will be started.
[1] 2293
Started L3 proxy process, initialization in progress. This might take a few minutes.
L3 proxy initialization is complete

06:38:04 END: Shut down all L3 farm programs
```

Entrance to Expert's Hall

Get controls for: SM b0eb10 ▼   Shortcut to reformatter message decoder

- Check status of primary components
- Start, stop proxies and do full cleanup of EVB and L3
- Reset state of any partition (e.g., in case of RC crashes)
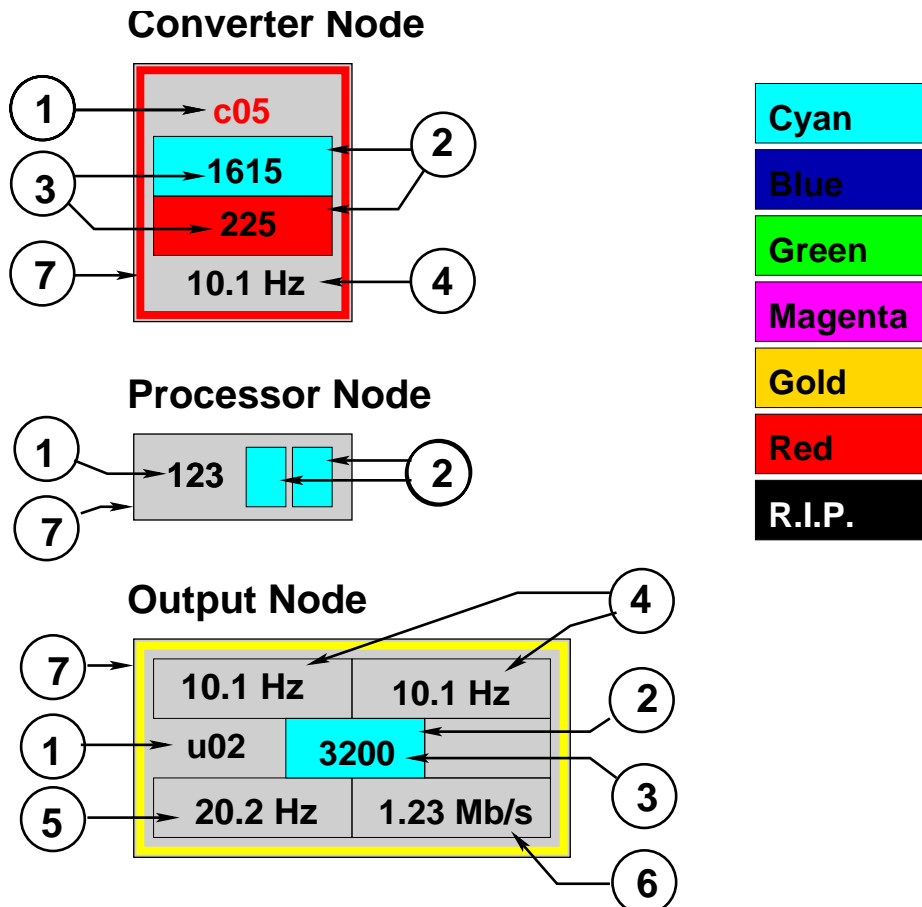- Gives access to EVB Expert GUIs and Reformatter Decoder

Level3 Display
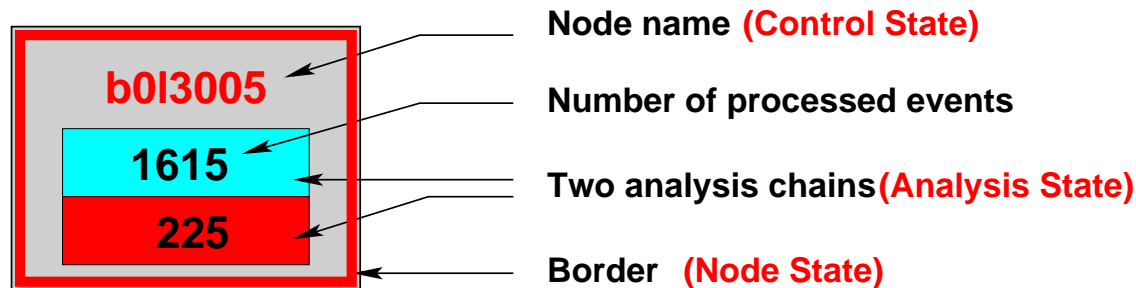
Level3 Display

Level3 Display

Level3 Display

Converter Node

① → **c05**
③ → **1615** ②
→ **225**
⑦ → **10.1 Hz** ← ④

Cyan
Blue
Green
Magenta
Gold
Red
R.I.P.

Processor Node

① → **123** ← ②
⑦ →

Output Node

⑦ → **10.1 Hz** | **10.1 Hz** ④
① → **u02** **3200** ← ②
⑤ → **20.2 Hz** | **1.23 Mb/s** ③
⑥

1. Node name. Color coded *Control* state.
2. Color coded *Analysis Chain* state. Two per node.
3. Number of processed events. (Converter and Output only)
4. Event rate for the subfarm. (Converter and Output only)
5. Output event rate for the Output node. (Output only)
6. Output data rate for the Output node.
7. Border. Color coded *System* state.

Note: To ensure the Display is being properly updated one may reset the window.
(E.g., when a node appears magenta but nevertheless procesing events.)

Level3 Display

b0l3005	→	Node name **(Control State)**
1615	→	Number of processed events
225	→	Two analysis chains **(Analysis State)**
	→	Border **(Node State)**

BLUE	CYAN	GREEN	MAGENTA	GOLD	RED	R.I.P.

Control State

- Error (red) - Level3 Errors (Click on the box to see Error messages).

Analysis State

- Input (Cyan) - Waiting for input.
- Busy (Dark Blue) - Chain is busy with event.
- Output (Green) - Waiting for output
- End (Magenta) - Node ended the run.
- Old (Gold) - Not updated. Probably monitoring failure.
- Dead (Red) - L3 Filter crashed. All necessary procedures are done automatically at the end of run.
- Unpingable (Black) - No connection to the node. If a node remains in this state for several minutes it is probably dead.

Node Hardware State

- Occasional yellow - Ok if not for the whole farm.
- Permanent red - System/HW problem (Disk full, memory, etc.)

For color map check Level3 Display Help menu.

L3 Partition Monitor of L3 Display

	State/Transition	Phase #/out of #	Time spent
Partition 0:	In transition: End	Collect EoR summary: 2/3	00:00:13
Partition 1:	Not defined	In state: 1/1	00:00:13
Partition 2:	Not defined	In state: 1/1	00:00:13
Partition 3:	Not defined	In state: 1/1	00:00:13
Partition 4:	Not defined	In state: 1/1	00:00:13
Partition 5:	Not defined	In state: 1/1	00:00:13
Partition 6:	Not defined	In state: 1/1	00:00:13
Partition 7:	Not defined	In state: 1/1	00:00:13

Shows states and transitions of hardware partitions.

Things worth checking

- How many hardware partitions are running with Level3.
- If bar State/Transition is yellow - Level3 received the RC transition message shown in the box.
- If field Time spent is more than 5 min - Failure.
- If all bars are red - Level3 Proxy is dead or L3 display lost connection. Check L3 Proxy from Ace Control Panel. Reset/restart L3 Display or restart L3 Proxy depending on result.

Level3 Summary

	0	1	2	3	4	5	6	7	

Level3 Summary

	Total	Inst. rate
Input	0	0 Hz
Reformatter rejected	0 (0.00%)	0.00 %
Filters rejected	0 (0.00%)	– – – – – – – – – –
Output	0	0 Hz

Last heartbeat:	Thu Aug 22, 08:00:30 2002
Current time:	Thu Aug 22, 08:00:30 2002

Shows input output and rejection rates/events.

Things worth checking

- Input count and rate. Compare with RC number.
- Reformatter rejection count and rate. If higher than threshold (1%) decode reformatter error, identify failing component.
- Filter rejection count and rate. If close to 100%,- do something. (Noisy Level1 trigger?)
- Output count and rate. Compare with CSL rates.
- Notice that each Level3 chain sends a "Begin Run" event to the output node at the end of ColdStart transition. Run begins with NON ZERO output event counter.

L3 Display: Node details
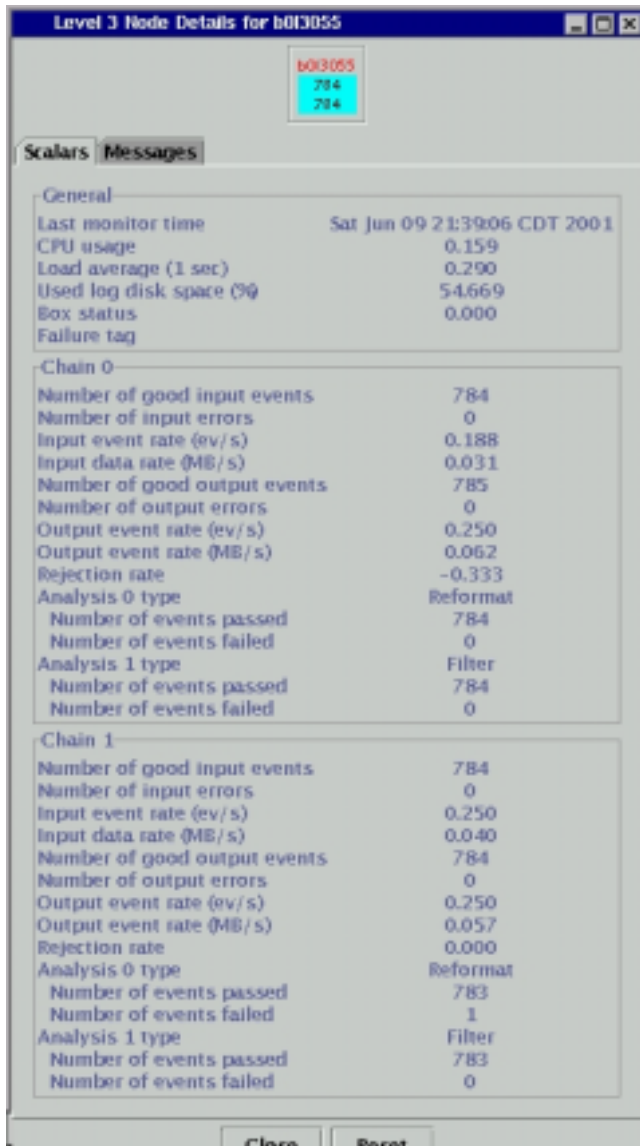
Things worth checking

- Monitoring heartbeat.
- Events pass/fail for Reformatter and L3 Filter.
- Number of input/output errors. (Esp. for converters)
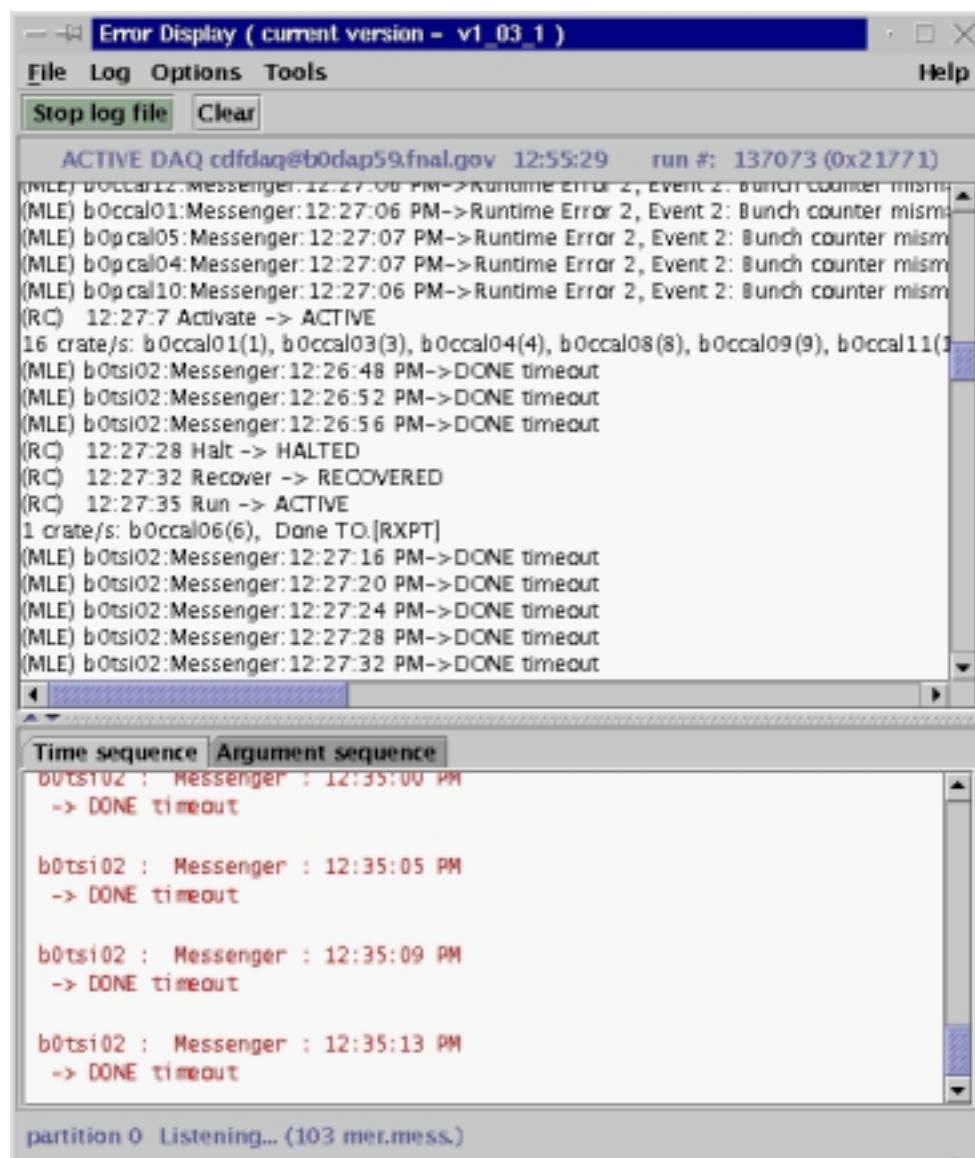- Input/Output data/event rate. One can find the size of the event by dividing data rate to event rate.

To open: click on any node of L3 Display

EVB/L3 errors and recovery
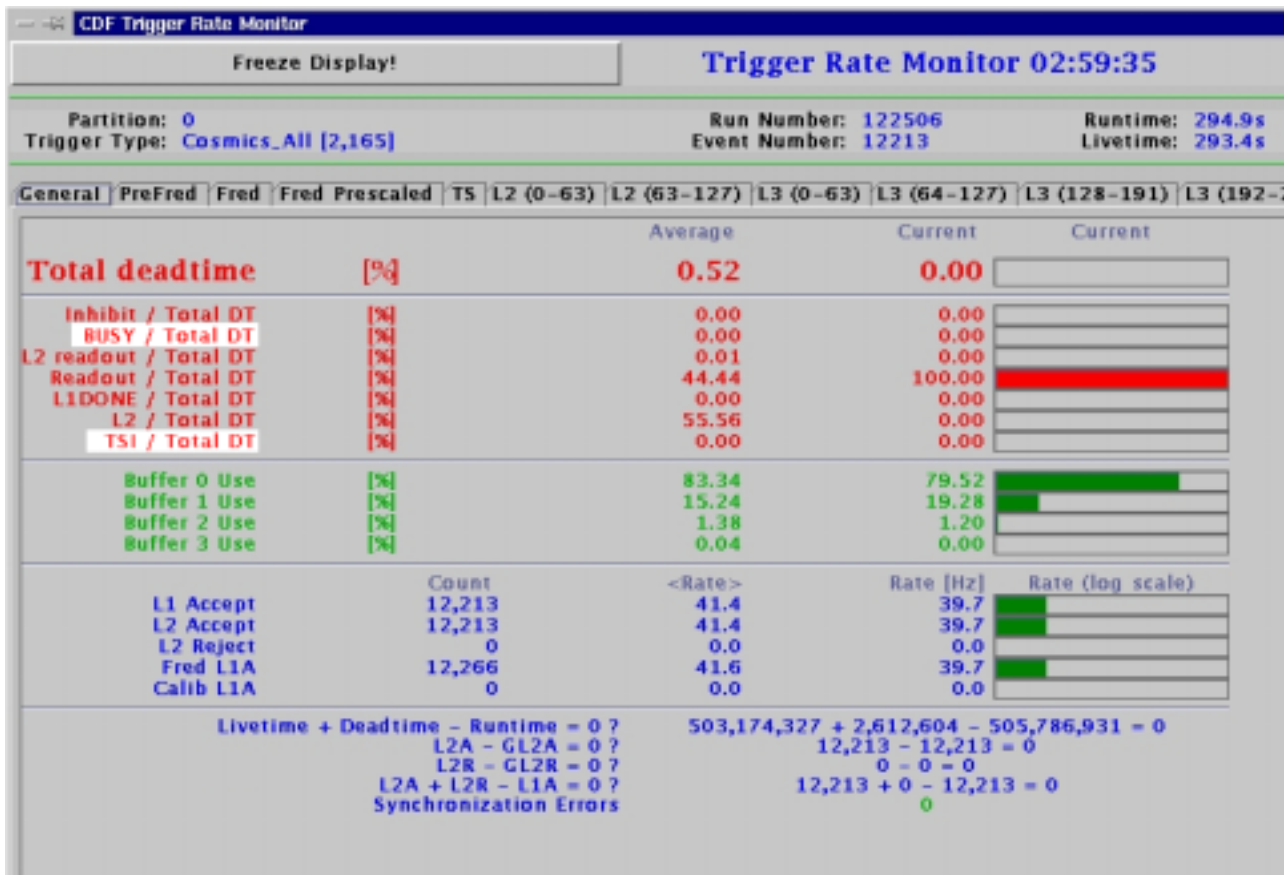
Run-time errors

- Deadtime.
- DONE timeout.
- BUSY timeout.
- Dealing with Reformatter Errors.
- Things worth to keep an eye on.

Error Logger

Read the error messages in the RC Error Logger to try to identify the problem better.

Deadtime Monitor

CDF Trigger Rate Monitor

Freeze Display!		**Trigger Rate Monitor 02:59:35**

Partition: 0	Run Number: 122506	Runtime: 294.9s
Trigger Type: Cosmics_All [2,165]	Event Number: 12213	Livetime: 293.4s

General | PreFred | Fred | Fred Prescaled | TS | L2 (0–63) | L2 (63–127) | L3 (0–63) | L3 (64–127) | L3 (128–191) | L3 (192–2

		Average	Current	Current
Total deadtime	[%]	0.52	0.00	
Inhibit / Total DT	[%]	0.00	0.00	
BUSY / Total DT	[%]	0.00	0.00	
L2 readout / Total DT	[%]	0.01	0.00	
Readout / Total DT	[%]	44.44	100.00	
L1DONE / Total DT	[%]	0.00	0.00	
L2 / Total DT	[%]	55.56	0.00	
TSI / Total DT	[%]	0.00	0.00	
Buffer 0 Use	[%]	83.34	79.52	
Buffer 1 Use	[%]	15.24	19.28	
Buffer 2 Use	[%]	1.38	1.20	
Buffer 3 Use	[%]	0.04	0.00	

	Count	<Rate>	Rate [Hz]	Rate (log scale)
L1 Accept	12,213	41.4	39.7	
L2 Accept	12,213	41.4	39.7	
L2 Reject	0	0.0	0.0	
Fred L1A	12,266	41.6	39.7	
Calib L1A	0	0.0	0.0	

Livetime + Deadtime – Runtime = 0 ?	503,174,327 + 2,612,604 – 505,786,931 = 0
L2A – GL2A = 0 ?	12,213 – 12,213 = 0
L2R – GL2R = 0 ?	0 – 0 = 0
L2A + L2R – L1A = 0 ?	12,213 + 0 – 12,213 = 0
Synchronization Errors	0

Inhibit   High voltage inhibit. Check HV monitor.

Busy: - VRB is full. Check EvbMon for pending events. Cleanup EVB if needed.

L2 readout: Problem between L2 decision crate and Trigger Supervisor. Reboot b0tsi00. Page TSI expert.

Readout: The time between FE crate receiving L2 trigger and set DONE signal is too long. Reboot the FE crate which causes the deadtime. Page expert.

L1DONE: Silicon trigger problem. Page silicon.

L2:   Alpha board problem. Not enough processor power. Reboot Alpha board. Remove b0l2dec00 from run. Page L2 expert.

TSI: - Interval0 (RC settings) is too big. EVB is too slow. Check EvbMon for pending events. Cleanup EVB if needed.

Trigger
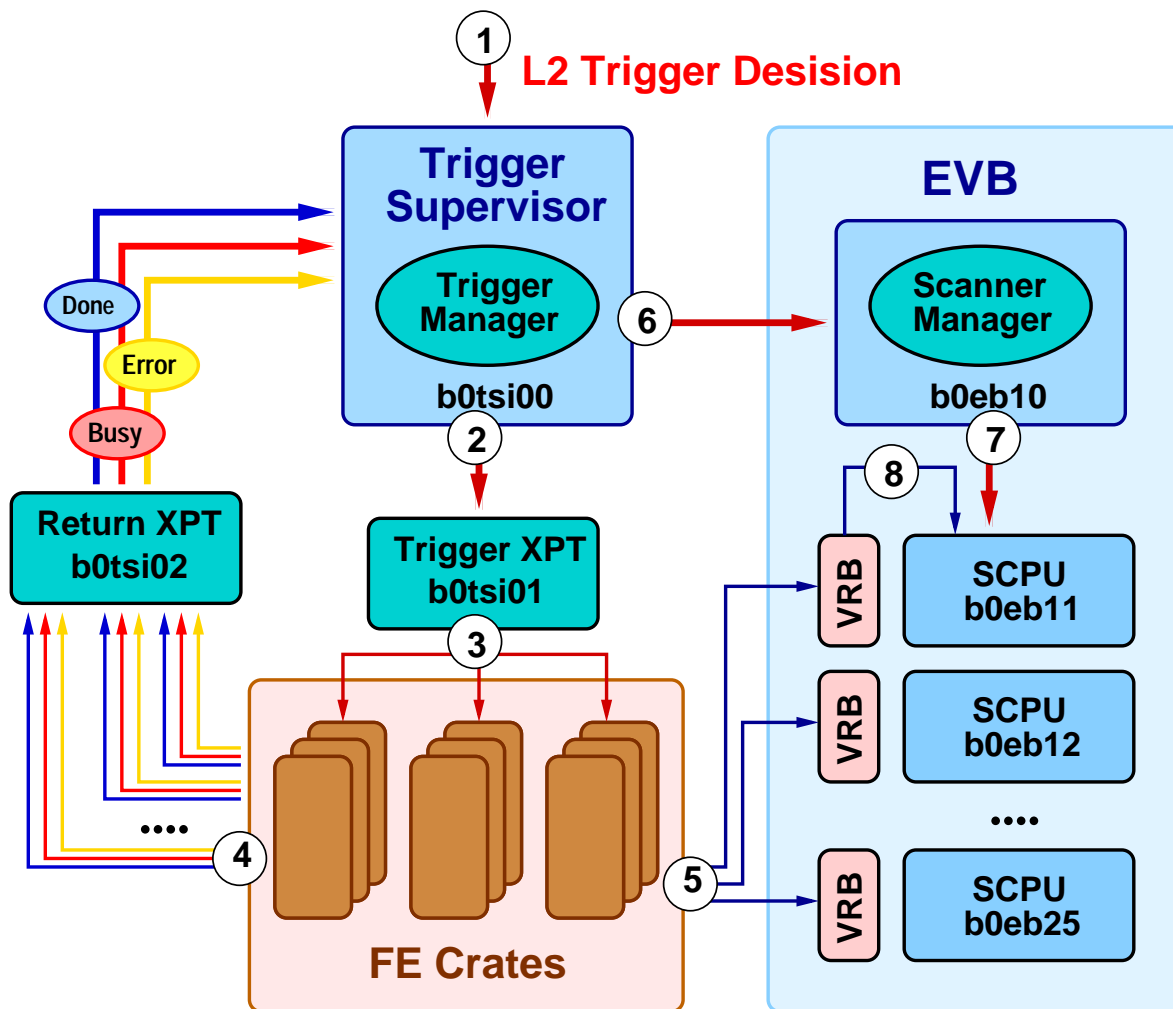
1. Trigger comes from Level2 to Trigger Supervisor (TS)
2. TS passes it to Trigger Cross Point
3. Cross Point fans it out to FE crates
4. FE crates load event and send DONE to Return XPT
5. FE crates start loading data to VRBs
6. TS send trigger to SM after getting all DONEs from FE
7. SM notifies SCPUs about trigger
8. SCPUs load data from VRBs and wait for further instructions from SM

Timeouts
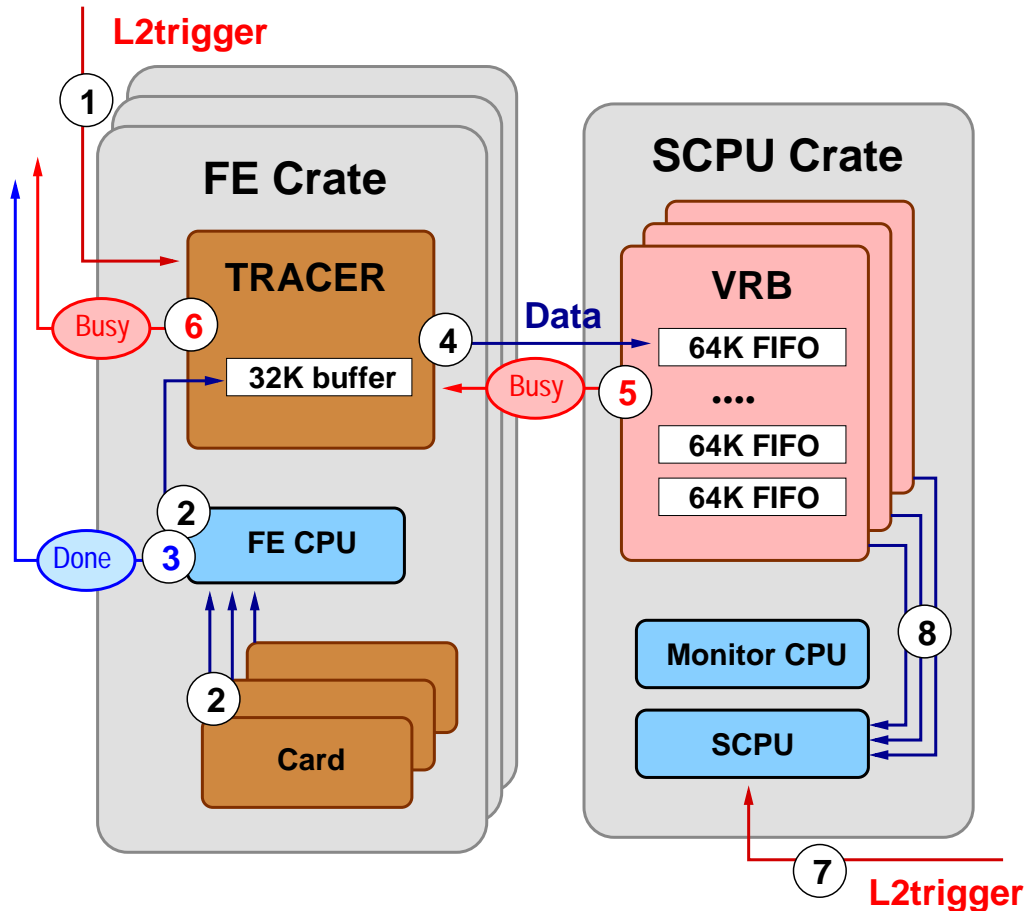
1. Trigger comes to Tracer from Trigger Cross Point
2. Cards load data to Tracer Buffer
3. FE CPU sets DONE signal if everything is ok. If DONE signal is not set Return XPT send DONE timeout to TS
4. Tracer sends Data to VRB FIFO
5. If FIFO is full VRB sends BUSY signal to Tracer
6. Tracer sends BUSY signal to Return XPT
7. If everything is ok SM notifies SCPUs about trigger
8. SCPUs load data from VRBs

Dealing with Reformatter Errors
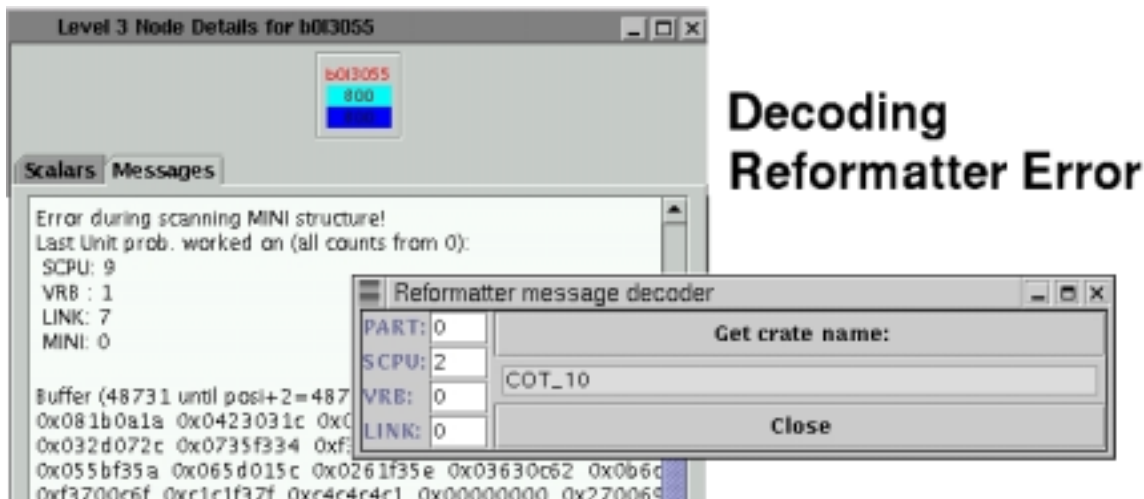
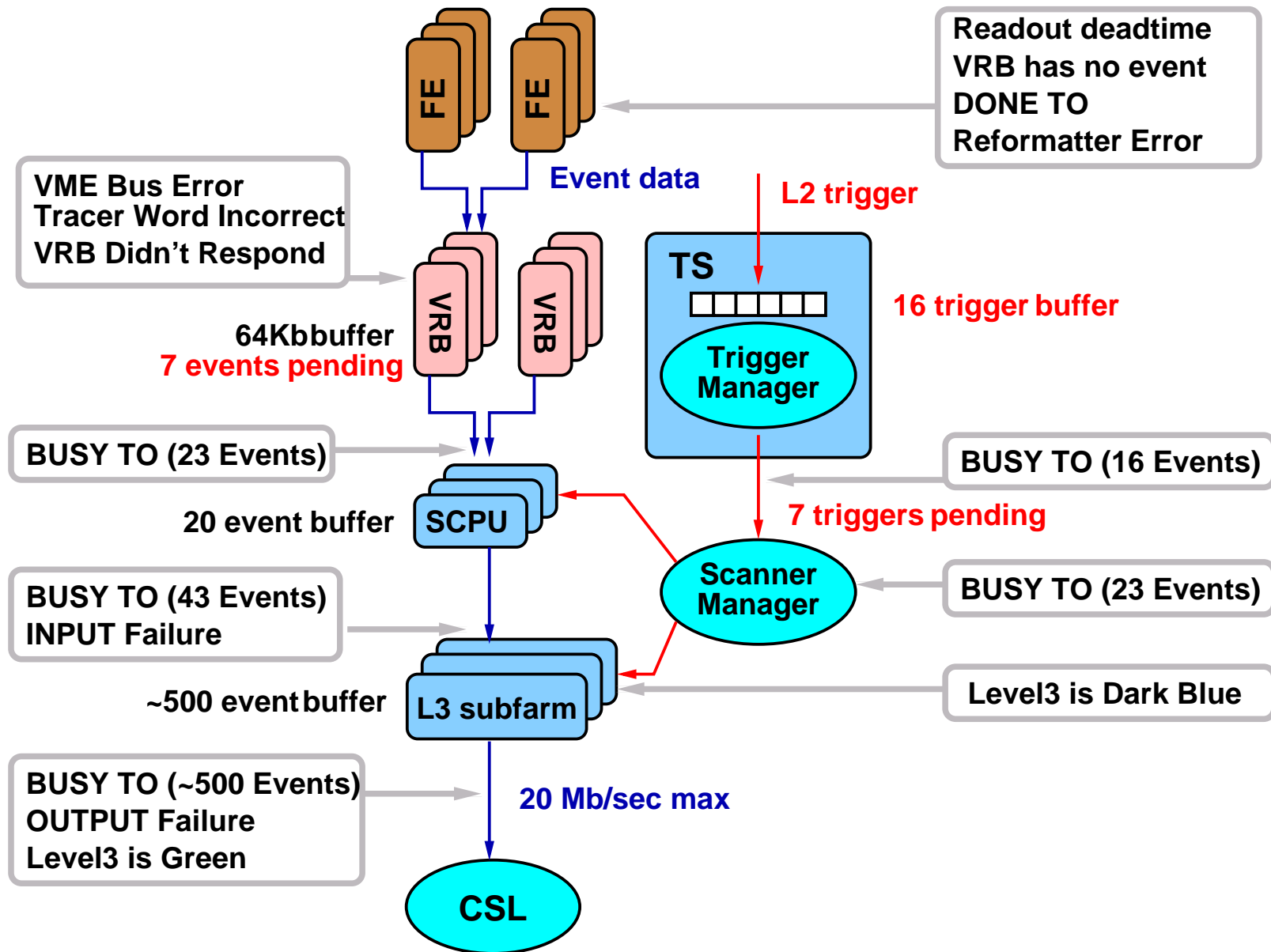Find relevant FE component with a tool started by green button on Ace Control Panel.

- You should be in Active or Idle state to use the tool.
- If you can not start the tool restart Ace Control Panel.
- Server is not found popup - try again, page Level3.
- Link is not in use popup - Corrupted data can not provide us with correct link number. Change link number to 0 and try again.

The reformatter rejection rate could be found on the L3 rate monitor (at bottom, right part of L3 Display).
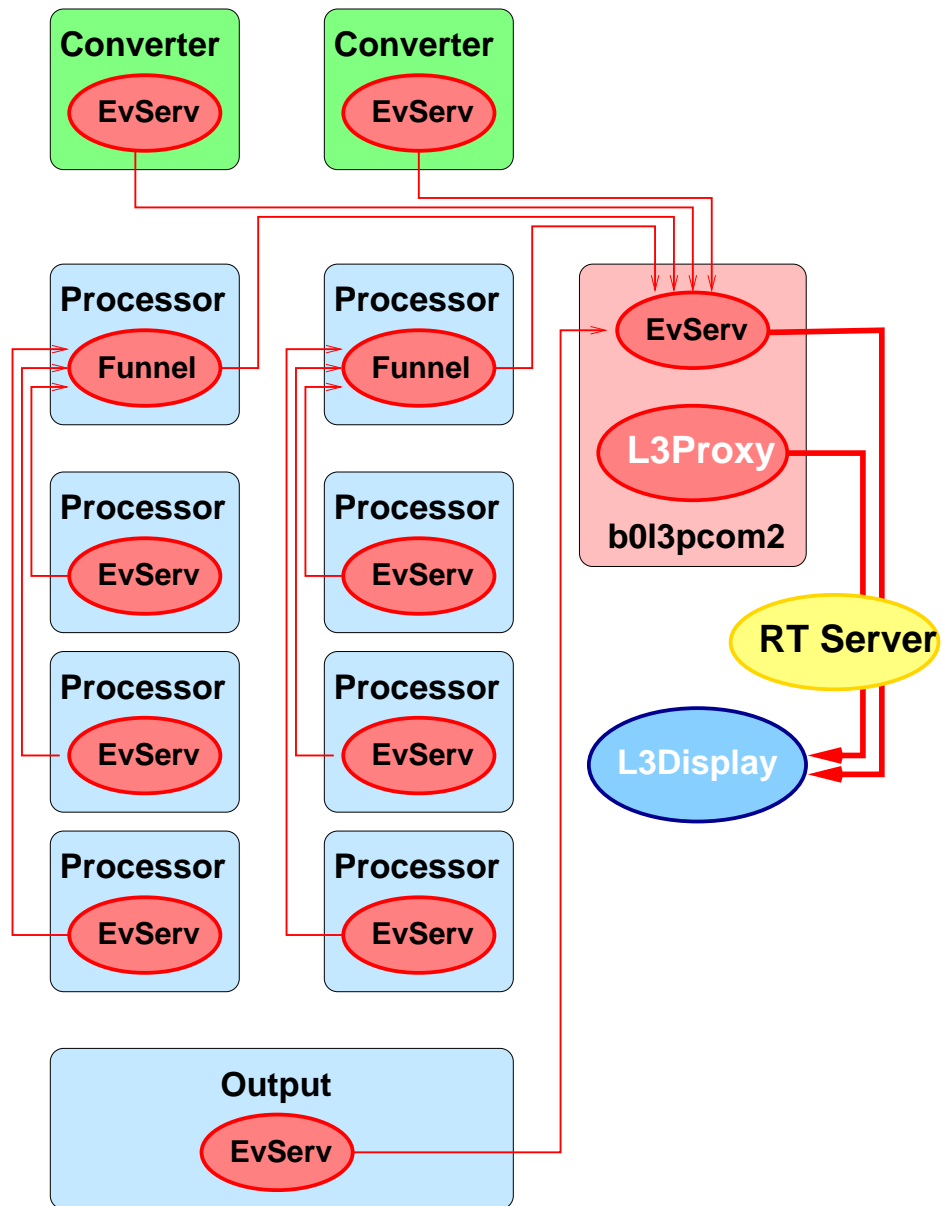A tool is also running, RefMon, which calculates the rejection rates over the last 30 seconds; If rejection exceeds some predefined level RC pops up an orange window with instructions for the Aces.
Check L3 Rate Monitor for reformatter error rate.

Networks, Buffers, Data Flow, Errors

Readout deadtime
VRB has no event
DONE TO
Reformatter Error

VME Bus Error
Tracer Word Incorrect
VRB Didn't Respond

Event data

L2 trigger

TS

Trigger Manager

16 trigger buffer

64Kbbuffer
7 events pending

BUSY TO (23 Events)

20 event buffer   **SCPU**

BUSY TO (16 Events)

7 triggers pending

Scanner Manager

BUSY TO (23 Events)

BUSY TO (43 Events)
INPUT Failure

~500 eventbuffer   **L3 subfarm**

Level3 is Dark Blue

BUSY TO (~500 Events)
OUTPUT Failure
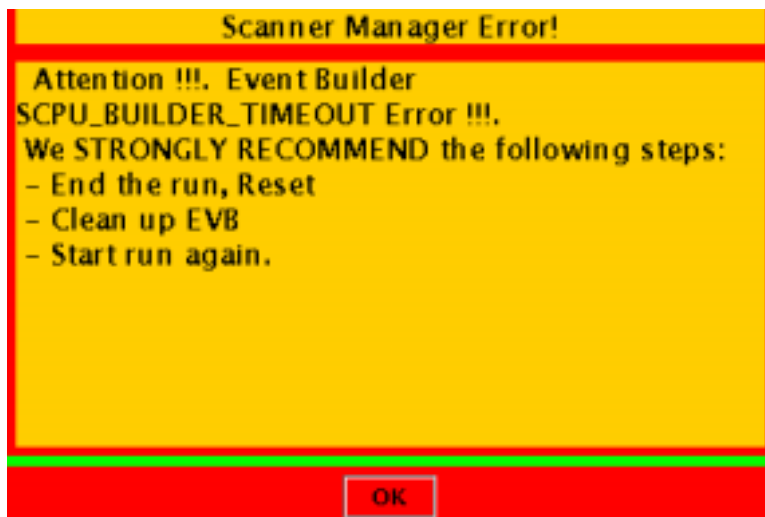**Level3 is Green**

20 Mb/sec max

CSL

Level3 monitoring data flow

- Eventserv - Accepts and sends monitoring messages.
- Event Funnel - L3 wrap for Eventserv. Accumulate monitoring messages. Sends them in 4 second intervals.

General Remarks

- If you get an orange popup window with EVB/Level3 problem follow the instructions.
- Check RC Error Display for error messages.
- Any transition can not take more than 5 minutes. If it takes more it means a problem.
- DONE timeout (Readout deadtime). - Problem with FE.
- BUSY timeout (Busy deadtime). - Problem with TS or EVB or L3 or CSL. (check Magic Numbers).
- Level3 is green - CSL problem.
- Level3 is gold - L3 monitoring problem.
- You have to be in START state when cleaning up EVB and Level3 or restarting Proxies.
- If you abnormally closed the partition you have to cleanup EVB.
- Check white board for information on currently available subfarms.

Things to Keep an Eye on

- L3 Display Color.
  - Green (Output State)- problem is downstream. Check if CSL is alive. 20Mb/sec is max CSL input capacity
  - Gold (Old) - Monitoring problem. Cleanup L3 mon.
  - Dark Blue (Busy State) - not enough process power. Use all available subfarms.

- Check if CSL is accepting events (read its monitoring tools).

- Check Rates and Dead time.

- Check Reformatter rejection rate.

- Look if Level3 proxy is alive.

- Look if EVB proxy is alive.

Other minimum knowledge

- Understand general information on Level3 Display.

- Be familar with Ace Controls for Level3 and EVB.

- Know the location of EVB components.

- Understand Deadtimes; Busy and Done timeouts.

- Know how to deal with Reformatter errors.

Assistance

Documentation

- Introduction for Aces, *CDF Note 5793* – please read.
- Manual, *CDF Note 6138*
- Help pages,
  http://www-cdfonline.fnal.gov/evbl3shift/evbl3shift.html

Note: html versions of the notes are available on the help pages as well.
Note: EVB/L3 help pages are linked from the general Ace help page.

Experts list

- Alberto Belloni
- Arkadiy Bolshov (pager)
- Boris Iyutin (pager)
- Nuno Leonardo (pager)
- Guillelmo Gómez-Ceballos
- Ilya Kravchenko

Note: Pager and telephone numbers are posted in the Control Room and Ace web page.

EVB/L3 help pages